ELECTRICAL TESTING.

Laboratory and Factory Tests in Electrical Engineering. By George F. Sever and Fitzhugh Townsend. Second edition, revised and enlarged. Pp. xii+269. (London: A. Constable and Co., Ltd.; New York: D. van Nostrand Co., 1908.) Price 10*s.* 6*d.* net.

IT is almost unavoidable that a book on laboratory practice, written by men whose duty it is to plan and superintend the work done by students, must savour somewhat of the instruction sheets which at universities are supplied to the laboratory classes. It is equally unavoidable that such instruction cannot be given in perfectly general terms, but must be adapted more or less to the syllabus in use at each particular university, and to the plant provided for the laboratory. Thus a work on laboratory tests may be exceedingly useful to students working at the particular laboratory to which it refers, but whether students at other institutions will be able to derive much benefit from it is doubtful. The advanced student and the scientific engineer, who is already in practice, will probably also be able to derive some advantage from the book under review, but he would reap the same advantage with less mental labour from any elementary text-book on electrical engineering. The words "factory tests" in the title must be taken to mean that the tests used in a particular laboratory may more or less also be used in a factory. This is, of course, true of all work carried out in a modern well-equipped laboratory, and, therefore, not a distinctive feature of the methods described in the present work.

It is certainly difficult to compress into 260 pages the whole subject of electrical testing, and want of space may be the reason why the authors have treated certain subjects in a very brief—one is almost tempted to say sketchy—manner, but I think they have not been judicious in the matter of curtailment, inasmuch as they have shortened or omitted altogether the exposition of general principles. On the other hand, they have unduly expanded the mere routine of testing. As an example of sketchy treatment of fundamental matters, take the Heyland diagram on p. 172 of the induction motor, which is given on the assumption that the motor has neither ohmic nor iron losses, and the various vectors are indiscriminately referred to as representing magnetomotive forces, currents, flux, or electromotive forces, without a word of explanation. That such treatment of a difficult subject must have seemed to the authors themselves somewhat unsatisfactory may be gathered from the following sentence, which occurs on p. 173:—

"This diagram has been so fully discussed in the literature of the induction motor that it is not thought necessary to reproduce the proof of it here."

Just so. The authors assume that the fundamental principles are known, and content themselves with giving mere rules for testing.

The book is divided into three parts. The first deals with preliminary measurements and with tests of continuous-current machines. In the second part we come to alternating-current machines and transformers, and then follows the third part, which bears the title "Electrical Measurements." This title is rather misleading, for here we find such subjects as the determination of the leakage coefficient of a dynamo, the Hopkinson method of testing for permeability, Ewing's hysteresis tester, Ewing's magnetic bridge, the plotting of the hysteretic loop—all subjects which one would rather call magnetic, not electrical, tests. However, a title which only fits part of the contents is not a serious matter, but that some electrical tests are treated in a very superficial manner is a decided drawback. Thus the Wheatstone bridge, which logically ought to have found a place in the first part, is dismissed in two pages of letterpress and a very imperfect diagram, whilst no mention is made of Varley's bridge or Thomson's double bridge. The potentiometer fares even worse. The diagram on p. 250 is crude and incomplete, and it is no help to the reader to be told on p. 251 that "for commercial use the potentiometer is usually arranged in some compact and convenient form." It is precisely the instrument as practically used with all its refinements that the reader expects to find in a book on laboratory and factory testing.

The third part also deals with tests on batteries and photometric work. Since both these subjects together occupy barely nine pages, it is clear that the treatment can only be very superficial. One feature of the book which strikes the reader as peculiar is that the authors omit in most cases to mention the origin of the methods they describe. Thus, Scott's name is not mentioned in connection with the change from three- to two-phase circuits, nor is Heyland's name mentioned when describing his diagram. Quite apart from the consideration that it is only fair to give credit where it is due, the suppression of such references is inconvenient to the reader. Certain discoveries, inventions, methods, or tests are known under the names of the men who first published them, and are usually identified in this manner. By omitting such means of identification, the young student loses touch with the subject he is supposed to acquire.

GISBERT KAPP.

SCHOOL ALGEBRAS.

(1) *Elementary Algebra—A School Course.* By W. D. Eggar. Pp. viii+324+28. (London: E. Arnold, n.d.) Price 3*s.* 6*d.*

(2) *A New Algebra.* By S. Barnard and J. M. Child. Vol. i., containing Parts i., ii., and iii., with Answers. Pp. x+371. (London: Macmillan and Co., Ltd., 1908.) Price 2*s.* 6*d.*

(3) *Algebra for Secondary Schools.* By Dr. Charles Davison. Pp. viii+623. (Cambridge: University Press, 1908.) Price 6*s.*

(4) *The Eton Algebra.* Part i. By P. Scoones and L. Todd. Pp. xxv+184. (London: Macmillan and Co., Ltd., 1908.) Price 2*s.* 6*d.*

(1) THIS book covers most of the ground required for boys who are not specialising in mathematics, with exercises in logarithms and a short chapter on trigonometric ratios. There are tables of

these functions and of square roots at the end of the book. There is an excellent collection of examples, many of which are of a practical type, and, therefore, in themselves more interesting than the old-fashioned academic questions. The proofs of formulæ and methods are in some cases somewhat concise, and would need amplification by the teacher. In particular, the proof of the binomial theorem and the explanation of the method of finding square roots are of this character. In some cases the author adopts the heuristic method, and requires the student to derive formulæ for himself, as, for instance, in finding the factors of $x^3 \pm y^3$ and $x^3+y^3+z^3-3xyz$, and in finding the meaning of fractional indices and the values of logarithms.

We should like to see less formal methods of finding the H.C.F. of two algebraic expressions, based on the fact that $R=aA-bB$ contains the common factors of A and B, as in many cases R can be factorised and the common factors detected with much less trouble and with a more direct appeal to common sense than by the formal method. The chapter on factors is very fully and carefully done, and this method would be a natural sequel.

The use of graphs is well exemplified and illustrated by a good number of examples. The chapters on ratio, proportion, and variation are good, especially in the selection of interesting practical examples.

(2) Messrs. Barnard and Child have made a brave attempt to give a logical development of algebra in a form suitable for school work. They explain the meaning of the laws of association, commutation, and distribution as applied to addition, subtraction, multiplication and division, and lead up to the solution of what are to a beginner quite difficult problems.

Negative numbers are not considered until part ii. (p. 149), and are there explained by extending the scale of natural numbers backwards. In this part some of the difficulties would seem to be too delicate for the comprehension of a beginner, as, for example, the distinction between $2+(-3)$ and $(-3)+2$. Every teacher must, of course, use his judgment as to how far to press such niceties. The explanations are carefully given throughout, and the collection of examples is excellent. The method of factors is applied to finding the H.C.F. and L.C.M. of a set of expressions; in fact, one special and excellent feature of the book is its early introduction to factorisation. As soon as a boy can factorise with facility, the expressions have a form and interest to him which they did not possess before. Fractions are introduced in part iii., and theorems on equal fractions (the authors avoid the use of the term "ratio") are given in chapter xx. Graphs are introduced in chapter xxiii., and illustrated by useful examples. The book ends with quadratic equations and problems leading to them, followed by a useful series of test papers. We look forward with interest to the appearance of the second volume.

(3) This is a book on the model of Todhunter, with the re-adjustments and improvements in methods of proof which modern requirements demand. Proofs of index laws and of the binomial and exponential theorems are given for all commensurable numbers, and are assumed, perhaps, however, somewhat too silently, to hold for incommensurables also, the author evidently considering it wise to postpone a rigorous treatment of incommensurables. Indeterminate equations of the first degree are introduced early, and clearly illustrated by well-drawn graphs. There are good chapters on permutations and combinations, and on the simpler tests of convergency and divergency of series, and the chapter on miscellaneous graphs forms a useful introduction to curve-tracing. Continued fractions and probability are not treated. The book is excellently printed, and there are a good number of examples attached to the various chapters, but rather a scanty supply of miscellaneous examples (100) at the end of the book. This could be remedied in a subsequent edition.

(4) This consists of a collection of examples up to quadratic equations, prefaced by a set of specimen examples worked out, to secure uniformity of method, and concluding with miscellaneous examples arranged in short sets, and graduated in difficulty, so as to test a boy's knowledge at various stages of progress. There is an extensive collection of graphs, each of which is accompanied by useful instructions as to scale. No bookwork is given, as it is considered that, in the early stages of algebra, all explanation must be left to the teacher.

OUR BOOK SHELF.

Agriculture for Southern Schools. By J. F. Duggar. Pp. xi+362. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 4*s.* 6*d.*

THIS little book has been written, the author tells us, as an elementary text-book on agriculture that shall differ from others in having a definite and limited field—the southern States of the United States. While the principles underlying the subject are universal, their applications vary much in different localities, and by confining attention to a particular area it becomes possible to present the subject in the concrete way essential for beginners. The crops, soil conditions, and general facts of cultivation are all within the experience of the scholar or his farmer friends, and he is not likely to be troubled with that *bête noir* of the agricultural teacher—the principle that is perfectly sound in itself, but not economical, and therefore not applicable, in the particular district.

A perusal of the book shows that the author has succeeded in his somewhat difficult task. The essential principles are well brought out, and the illustrations are to the point. The opening chapters deal with the structure of the flower and seed-formation: peach, cotton, tobacco, and others being chosen as examples. The conditions necessary for germination and plant growth are then discussed, and the author next passes on to the highly important problem of adapting the crop to the soil. So much money has been lost in the past through planting crops unsuited to the soil that the author does well to direct attention to this matter; he points out, for instance, that sandy soils are best cropped with early vegetables, peaches, cotton, pea-nuts, water-melons, &c., while clay soils are better for hay crops, apples, &c. A few chapters are then devoted to manures, and